

THE DAILY RECORD-UNION.

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For one twenty-first, in advance, \$0.0000048.

For one twenty-second, in advance, \$0.0000046.

For one twenty-third, in advance, \$0.0000044.

For one twenty-fourth, in advance, \$0.0000042.

For one twenty-fifth, in advance, \$0.000004.

For one twenty-sixth, in advance, \$0.0000038.

For one twenty-seventh, in advance, \$0.0000037.

For one twenty-eighth, in advance, \$0.0000035.

For one twenty-ninth, in advance, \$0.0000034.

For one thirtieth, in advance, \$0.0000033.

For one thirty-first, in advance, \$0.0000032.

For one thirty-second, in advance, \$0.0000031.

For one thirty-third, in advance, \$0.000003.

For one thirty-fourth, in advance, \$0.0000029.

For one thirty-fifth, in advance, \$0.0000028.

For one thirty-sixth, in advance, \$0.0000027.

For one thirty-seventh, in advance, \$0.0000026.

For one thirty-eighth, in advance, \$0.0000025.

For one thirty-ninth, in advance, \$0.0000024.

For one fortieth, in advance, \$0.0000024.

For one forty-first, in advance, \$0.0000023.

For one forty-second, in advance, \$0.0000022.

For one forty-third, in advance, \$0.0000022.

For one forty-fourth, in advance, \$0.0000021.

For one forty-fifth, in advance, \$0.0000021.

For one forty-sixth, in advance, \$0.000002.

For one forty-seventh, in advance, \$0.000002.

For one forty-eighth, in advance, \$0.0000019.

For one forty-ninth, in advance, \$0.0000019.

For one fiftieth, in advance, \$0.0000019.

For one fifty-first, in advance, \$0.0000018.

For one fifty-second, in advance, \$0.0000018.

For one fifty-third, in advance, \$0.0000018.

For one fifty-fourth, in advance, \$0.0000017.

For one fifty-fifth, in advance, \$0.0000017.

For one fifty-sixth, in advance, \$0.0000017.

For one fifty-seventh, in advance, \$0.0000016.

For one fifty-eighth, in advance, \$0.0000016.

For one fifty-ninth, in advance, \$0.0000016.

For one sixtieth, in advance, \$0.0000016.

For one sixty-first, in advance, \$0.0000015.

For one sixty-second, in advance, \$0.0000015.

For one sixty-third, in advance, \$0.0000015.

For one sixty-fourth, in advance, \$0.0000015.

For one sixty-fifth, in advance, \$0.0000014.

For one sixty-sixth, in advance, \$0.0000014.

For one sixty-seventh, in advance, \$0.0000014.

For one sixty-eighth, in advance, \$0.0000014.

For one sixty-ninth, in advance, \$0.0000013.

For one seventieth, in advance, \$0.0000013.

For one seventy-first, in advance, \$0.0000013.

For one seventy-second, in advance, \$0.0000013.

For one seventy-third, in advance, \$0.0000012.

For one seventy-fourth, in advance, \$0.0000012.

For one seventy-fifth, in advance, \$0.0000012.

For one seventy-sixth, in advance, \$0.0000012.

For one seventy-seventh, in advance, \$0.0000011.

For one seventy-eighth, in advance, \$0.0000011.

For one seventy-ninth, in advance, \$0.0000011.

For one eightieth, in advance, \$0.0000011.

HALE BROS. & CO.

DRESS NOVELTIES!

We have just received direct from New York, and are

THIS WEEK

—SHOWING SOME ENTIRELY—

NEW AND ELEGANT DESIGNS

Dress Materials

—FOR—

Spring Wear!

The highest novelty out this season is the

"Benzaline" Combination!

The material is Silk and Wool, and is 46 inches wide. The trimming is especially designed for the same.

Similar to the "BENZALINE" is a very stylish Pin Check Combination, in All-wool and Double-width. The Trimming for this, like the "Benzaline," is designed expressly for it, and can be used with no other goods.

In the less expensive goods, we have some very pretty effects, and a large assortment to select from, consisting of:

TABREZO CLOTH AND SCARBORO SUITINGS!

We would invite particular attention to our

COLORED AND BLACK MOIRE STRIPED SILKS AND SATINS!

Which, upon examination, will be found decidedly cheap, and excellent value for the money.

In the lighter weight Dress Material for Summer wear, we are showing some beautiful goods in

COLORED DOTTED SWISS, DOTTED SWISS,

LINEN LAWN, PIQUES, NAINSOOKS & TARLATAN.

The patterns in these goods are entirely new and decidedly pretty, and we are confident that the most esthetic and fastidious can make agreeable selections.

SPECIAL!—Just received from New York, ONE CASE OF BRIGHTON SUITINGS, a nice, inexpensive Dress Material, which we have placed on our counters at the extremely low price of 8-13 cents per yard.

Parasols! Parasols!

Our stock of PARASOLS is now complete, making a large and elegant collection in all of the latest style Lace, Silk, Satin, Cotton and Japanese.

Orders by Mail receive special attention, and are filled the day they are received.

HALE BROS. & CO.

829, 831, 833, 835 K street,

1026 NINTH STREET, SACRAMENTO.

TERRIFIC STORM.

Frightful Work of a Cyclone in the Northwest.

GREAT NUMBER OF LIVES LOST.

Houses, Fences and Trees Levelled with the Ground.

[SPECIAL BY TELEGRAPH TO THE RECORD-UNION.]

CHICAGO, April 7th.—A Topeka (Ks.) special says: A cyclone started south of the Arkansas, near Raymond, Rice county, last night, and moved in a northerly direction. It prostrated the telegraph poles when it crossed the Santa Fe tracks. John Wilson's house was blown down. Mrs. Wilson killed, and a Mrs. Parker fatally injured. Several other large houses were demolished. Proceeding north, the storm struck the new town of Chase, and demolished 22 of the 23 buildings in the place, threw cars from the tracks and did other damage. Mr. Reed, a hotel-keeper, was killed, his wife fatally hurt, and another woman and child killed about the same time.

A small cyclone, with a veritable water-spout, passed through the eastern part of the county later in the day, but did little damage except by drowning out stock. At E. B. Lawrence's farm the water was sucked out of wells. The cloud as it approached Chase was funnel-shaped, whirling and twisting with fearful velocity. All the inhabitants of Chase were more or less hurt. Among the losses are Eckles Bros., storehouse destroyed with \$2,000 worth of goods. E. J. Shattuck's storehouse and residence; loss, \$3,000. Arthur House and Deane's storehouse and lumber; loss, several thousand dollars. George F. Miller's new business house, \$1,800. Congregational church, \$1,500. Reed's Hotel was blown down. The Methodist church, dedicated Sunday, was twisted one quarter round and badly wrecked. Several houses were overturned. Muscott Bros.' store was damaged and stock ruined. Apple's drug store was blown off its foundation. The depot was unroofed, and several parties killed, whose names are not given. The people are living in box cars, and many are destitute.

FURTHER DESTRUCTION. A special from Clyde station, Mich., reports a terrible hurricane near Highland station, on the Flint and Pere Marquette road, south of Holly, early last night. The extent of damage is unknown, as the telegraph line is down and the railroad agent walked to Clyde to send what he knew. The dwelling of a man named Crandall was blown down, Crandall and one child killed, and a daughter severely injured. A guest, Mrs. Taylor, of Pontiac, was also killed, and several other persons injured. The hurricane covered an area of less than half a mile wide, but leveled everything within its path.

There are reports also of high and destructive winds and heavy rains in the vicinity of Keokuk and along the Wabash and Rock Island roads in Iowa. At Keosauqua and Hamilton, in Iowa, and Kaskaskia and Ashton, Missouri, the damage was very severe, but full particulars are wanting because telegraphic communication is shut off.

HOUSE LIFTED INTO THE AIR AND DASHED TO PIECES.

EAST SAGINAW (Mich.), April 7th.—About 6 o'clock last evening a tornado swept over the territory northeast of Midland village, twenty miles west of this city, doing considerable damage. The residence of a farmer named E. E. Walton was picked up bodily and capsize, tearing it into pieces. The wreck took fire from the stove and burned up. The family were all injured, Mrs. Walton severely. A hired man had his shoulder broken and a child had an arm broken. The barn was torn into shreds. Other property in the neighborhood was damaged. The house of a man named Wood, living on Saginaw creek, was blown down, and Wood severely hurt.

BUILDINGS GROUND TO ATOMS.

CHICAGO, April 7th.—The Evening Journal's special says: A terrific tornado passed through the township of Kalamazoo, Eaton county, Michigan, last night, which did immense damage to houses and barns, and killed a large amount of live stock. Several lives are reported lost and many injured. The place is remote from travel and telegraph.

After particulars of the Oakland county storm, L. Fayette Crandall, his sisters and little boy, and Mrs. Henry Taylor were killed, and his little girl's arm was badly crushed as to require amputation. Mrs. Oscar Ward was also injured. The debris looks like an explosion. Everything is ground to atoms. One horse was blown out of a barn and found in a distant field covered with mud.

An idiot sister of Horace Sherman was killed, and his other sister's leg broken. His wife's jaw was dislocated, and the whole family carried fifty rods and thrown into a swamp and badly bruised.

A REGULAR CYCLONE.

KALAMAZOO (Mich.), April 7th.—A severe storm occurred in this region yesterday afternoon. As Kendall, on the South Haven road, there was a regular cyclone. Mr. Wilder's house was blown down. He was killed and a wife and friend injured. Other buildings were unroofed. The cyclone moved east across the northern part of the county, unroofing barns and doing other damage. It is rumored that a man was killed in Cooper township.

WOMAN KILLED AND SIX OTHER PERSONS INJURED.

CLAY CENTER (Ks.), April 7th.—Heavy rains have occurred for two days. A wind-storm struck the house of John Rocks last night, five miles northeast of this town, and tore it into splinters, killing Mrs. Mann, a daughter-in-law of John Rocks, and injuring six other persons. The storm did no other damage.

THE PATH OF THE HURRICANE.

DETROIT, April 7th.—There is not much fuller intelligence from the tornado near Highland. This storm appears to have first struck on the farm of Joseph Bird, near Highland Corners, damaging it considerably. It then passed east, blowing down fences, trees, everything in its path, and next striking the barn of George Lewis, making it a complete ruin. The house of Orson Kellogg was badly damaged. Then the house of L. Crandall, where the loss of life heretofore reported occurred. Then it passed east and struck the residence of Mrs. Deering, damaging it considerably. It then struck the house of Mr. Beaumont, damaging it, and blowing the barn into the lake. The house of Alonzo Deane was badly damaged. The track of the storm was about forty rods wide.

SAN FRANCISCO.

SPECIAL TO THE RECORD-UNION.

The Effect of the Veto.

SAN FRANCISCO, April 7th.—The effect of the veto continues the principal topic of conversation in political circles. The Democrats expect to capture many votes among the Republicans of the disaffected class, and their leaders propose to take no chances of a walk-out on that account, and are making every effort to effect a solid organization. The feeling of despondency among the Republicans is giving place to a belief that the disposition shown by the Democrats in Congress to obstruct further consideration of the Chinese question will react against them.

It is reported that active steps are being taken in the city to organize anti-Chinese clubs. This is a serious matter, and the Chinese and some indifferent persons are reviving the talk of violent measures, and hinting at armed organizations. It is questionable how much backing there may be to such talk.

Anti-Chinese Meeting.

SAN FRANCISCO, April 7th.—At a meeting held this evening in front of the Mint, a protest was read and adopted, earnestly and solemnly protesting against the trades and business now engaged in by the Pacific Mail Steamship Company and others, in importing coolies, declaring that such trade is a violation of justice and humanity, and done in violation of the expressed will of the people. The meeting was very large, and the speakers questioning all owners and masters of vessels to desert from such traffic, and if they persist in the trade in defiance of the popular will, it should be as at the time of the Chinese Exclusion Act of May, 1882, all coolies in San Francisco shall be confined to the following limit: Pacific street on the north; Kearny street on the east; Sacramento street on the south; and Stockton street on the west; and that after the above date no Chinese shall be allowed to pass outside the above limits, except for the actual purpose of embarking for China.

Democratic Reorganization.

SAN FRANCISCO, April 7th.—The Committee of Fifty on reorganization of the Democratic party of the city, and the District Committee of two from the County Committee met this evening, and reports of the organization of localities in the Ninth, Tenth, Eleventh and Twelfth Senatorial Districts were presented. The reports indicated the name of each temporary President of the organized club. All reports were adopted, and after the transaction of ordinary routine business the committee adjourned subject to the call of the President of the Committee of Ten.

The Panama Canal.

SAN FRANCISCO, April 7th.—H. B. Slaven, of this city, has just returned from a visit to the isthmus of Panama, where he is interested in a sub-contract on the De Lesseps Canal. He said that the report of the canal and death among the canal employees has been very much exaggerated. Of the foreign population on the canal, averaging from 1,000 to 2,000, the deaths last year numbered less than 100. The principal disease is Panama fever. There are at present about 2,000 men employed by the dredging machine. His wife, who was away from home a few days ago. He had just received the money as back pension since 1863.

Robbed of His Back Pension.

PORTLAND, April 7th.—J. B. Cherry, of Oregon City, has reported to the police authorities the robbery of \$600 from a trunk in which he is a laureate of the money from home a few days ago. He had just received the money as back pension since 1863.

Robberies—Gambler Killed.

PORTLAND, April 7th.—Charles F. McBride, traveling agent of Huntington, Hopkins & Co., Sacramento, was robbed of a sample case valued at \$200 at Colfax. The robbery was traced to some recruits en route to Fort Walla Walla from Jefferson barracks, Missouri, and the case was recovered. The recruits were put under arrest. The jewelry store of H. B. Royal, at Astoria, was robbed last night, and eighteen watches stolen. No clue to the thieves. It is reported here tonight that Harry H. Higley, a cook, formerly of Portland, shot and killed Jack Sullivan, a gambler, at the Fifteenth mile precinct, Wasco county, in self-defense.

Crushed to Death.

SAN FRANCISCO, April 7th.—Herman F. Stiner, an employe of Holbrook, Merrill & Stinson, wholesale store, at Market and Beale streets, was killed this afternoon by a piece of machinery falling upon him.

Boy Killed by a Fall.

SAN FRANCISCO, April 7th.—A boy named Charles J. Kohler, living at 237 Stevenson street, and employed in Bancroft's printing house on Market street, this morning at about 11 o'clock fell through the elevator hatch on the fifth floor, and was instantly killed by striking on the pavement in the basement. The lad was fifteen years old.

Drowned Sailors.

SAN FRANCISCO, April 7th.—John Clark, the mate of the codfish schooner H. L. Excelsior, which, after missing stays, struck on Mile Rock, and was subsequently run ashore at Loma Point, was washed off Mile Rock, on which he jumped to safety, and was killed. B. Sheehan was also washed overboard a few minutes later and drowned. Neither of the boats were recovered. The bodies were saved from the wreck before the sails and rigging, etc.

Unknown Man Found Drowned.

SAN FRANCISCO, April 7th.—The body of an unknown man was recovered from the bay south of Alcatraz Island at half past 7 o'clock this morning, and taken to the morgue. The remains are those of a man about forty years of age, five feet six inches in height, dark hair, sandy mustache, dark complexion and regular teeth. On the back of the right hand was a tattoo of a cross, and on the left forearm a wreath encircling a heart with an arrow through it, surmounted by a star and the letters "H. L." under the heart, all done in India ink. The body was clothed in a dark diagonal cloth suit, and in the pockets was a ten-cent piece, a razor, five keys, pocket knife, gold collar button and a green shade for one eye.

A Week's Mortality.

SAN FRANCISCO, April 7th.—During the past week the total number of deaths reported to the Health Office was 101—males 56, females 45.

THROWN OUT OF COURT.

of the United States Circuit Court, on Thursday dismissed a suit brought by \$10,000,000, begun some time ago by Randolph Danmyer against the Bonanza firm. The suit was for an accounting of the affairs of the Consolidated Virginia Mining Company. Plaintiff claimed that the defendants, in the corporate capacity of the Pacific Refinery, Pacific Lumber Company, etc., had defrauded the Consolidated Virginia stockholders out of the mentioned amount of money. The Court sustained a demurrer, on the ground of insufficient allegations and statute of limitation.

Mrs. Celeste, just deceased, received from Yates, manager of the Adelphi, the father of Edmund Yates of the London World, \$250 a week, considered a very large salary, though Rose Coghlan has been here. She played characters requiring little speech or action, as she had an accent, and it was regarded, in her time, as an unparadise sin to mispronounce the language of the stage. Since Celeste's day she made a large fortune, and retired to enjoy a well-earned repose.

PACIFIC SLOPE.

General Sherman and Party—Pension Money Stolen—Arthur Hung in Jail—Accidents at Grass Valley—Fatal Quarrel Over a Dollar—Etc.

NAPA, April 7th.—President Arthur was today hung in jail for his late action on the Chinese bill.

MERCED, April 7th.—Universal condemnation of the President for his action is expressed in public and private, and the citizens have given emphasis to their sentiments of indignation by hanging President Arthur in effigy on the same gibbet with an image dressed as a Chinaman. Both will be burned to night.

A Couple of Accidents.

GRASS VALLEY, April 7th.—Charles Hudson had his foot badly crushed today by a piece of iron falling upon it at the Idaho mine.

Cornelius Leary, by a car tipping over on him, had his right thigh-bone broken.

The Amateur County Homicide.

IONE CITY, April 7th.—The Coroner's jury in the case of Thomas Nurse, who was killed by Wm. Kirkendall yesterday, rendered a verdict of unjustifiable killing. Kirkendall is in jail. The testimony of his own family was very damaging against him. The community seems very much incensed against the priest. He will be examined tomorrow before Justice Church, of Drytown.

General Sherman and Party.

WILCOX, April 7th.—General Sherman and party arrived today, and camped at Fort Stone this evening; thence to Huachuca and Tucson.

NEVADA.

Killed for a Dollar.

CANDELARIA, April 7th.—Last night Peter Sully, Jr., shot and instantly killed Nicholas Greigovich, at Columbus, eight miles east of here. The trouble was about a dollar. A woman of the town had young Sully's watch in pawn for \$4. The woman carried the watch to Greigovich and got \$4 on it, telling him Sully would redeem it. When she saw Sully she told him he owed Greigovich \$3 on the watch. Sully went to Greigovich, and when Greigovich came to the watch, Sully shot him dead. Greigovich was an old resident of Columbus, and much respected. Sully is a young man barely out of his teens.

OREGON.

Robbed of His Back Pension.

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UNIVERSITY ANNOUNCEMENT.

President Reid, of the State University, will in a few days send out to the High Schools of this State a circular letter concerning preliminary examinations, setting out that any candidate for admission to the University may, at his option, pass the entire examination at one time, as heretofore, or he may pass a preliminary examination on a part of the requirements, and be examined on the remaining part at the following year; but neither the preliminary nor the concluding examination may be divided between the June and the August examinations. Candidates will not be admitted to the preliminary examinations without certificates from their teachers that they are prepared. These certificates should be sent to Recorder Wm. Carey Jones, Berkeley, at least two weeks before the examination. A fee of five dollars will be charged to applicants at Los Angeles and Marysville. Examinations June 1st, 21 and 3d.

No certificate of proficiency will be given upon the preliminary examination unless the candidate passes at least six of the eight prescribed subjects. Candidates for the



## A SERIES PREPARED ESPECIALLY FOR THE "RECORD-UNION."

Presenting Instruction Contained in Lectures from the Chair of Agriculture, State University.

## [THIRTEENTH PAPER.]

The wood of *Xylocopa* stems consists of four parts. These are the pith, medullary sheath, the layer of wood and the medullary rays. The first and last belong to the woody system of plants, and the second and third to the cellular system. The pith is too well known to need description. The medullary sheath consists of a system of spirally-coiled ducts, encircling the pith. These seem not to be special organs, but simply the vascular tissue in its early stages of development. The layer of wood consists of woody fiber, interspersed with vascular tissue. It is this vascular tissue which gives the peculiar dotted appearance to the ends or cross sections of some stems, especially those of the softer-wooded trees, and in which the vascular tissue is accumulated in the inner parts of each layer. In other trees, such as maple, larch, etc., the vascular tissue is so minute as to be invisible, and the wood presents a close, regular appearance. The medullary rays are the lines radiating from the center on the cross-section of the stem; they are evidently for the purpose of keeping up the communication between the pith and bark of the plant.

## THE ACTUAL GROWTH

Of an exogenous plant takes place in the cambium layer. This is a more or less liquid layer situated between the wood and the bark, and consists of mucilaginous matter. This sap is made of organic matter, in which new cells are constantly being formed, some of which go inward to form new wood, while others are deposited in the inner surface of the bark. There is always a connective tissue of thin and very delicate cells between the wood and bark, and in which the process of cell multiplication goes on most rapidly. It is by the annual renewal of growth in the cambium layer that the growth of the exogenous stems is affected. The annual increase being deposited in cylindrical layers, a cross section of the stem shows more or less perfectly the annual deposition in concentric rings between the pith and the bark on trees growing in a climate where there is a marked difference between the temperature of different seasons; and where there is therefore a growing and a dormant season, these concentric rings are most marked, and their number gives quite accurately the age of the tree. The stem not only serves to support the foliage of the tree, but it also serves as a channel through which the liquids derived from the soil are forced by the root up into the leaves and growing extremities of the tree. The stem also, through the medium of its tissue, allows the descent of the water which has been accumulated from the atmosphere by the leaves.

## LEAVES.

Leaves consist of a membrane of cells arranged on and supported by a framework of fibers and ducts. In the earliest stages they are imbricated or folded together in the buds, but with the growth of the plant they expand and immensely increase the lateral surface of the plant. Some plants, notably the cactus, seem to have no leaves, and the stem performing the function of the leaves. Johnson expresses this relation very aptly when he says "many of these plants above ground are in form all stem, while in structure and function they are all leaf." The green color spoken of as being characteristic of the cellular layer of the outer bark is also invariably found in all vigorous and healthy leaves. This green color is due to the presence of chlorophyll, a substance which has already been described. In autumn, with the cessation of growth by deciduous trees, or at the maturity of the plant, as in the grains, the leaves lose their green tint and fade or altogether lose their color, the leaf stops performing its functions and soon drops off. Although leaves differ greatly in form and appearance, yet their structure is essentially the same. The leaf, like the stem, is made up of two distinct parts—the blade and the petiole. The cellular part consists of the membrane and pulp of the leaf, and the woody part of the framework of fibers and ducts. It is this framework which gives strength to the leaf, and which forms the medium through which the sap is conveyed and distributed to every part of the leaf. The subdivisions of the ribs and veins continue to ramify among the pulp and membranes, even to the very smallest cells, so that the entire leaf is a comparatively dense surface. The cells of the lower strata are very loosely and seemingly irregularly arranged, with numerous spaces between the cells. The cells, if elongated, are generally arranged parallel to the surface of the leaf. The more dense and compact nature of the upper surface of the leaf accounts for the darker shade of green than that on the lower surface of the leaf. All of the spaces between the cells are filled with matter deposited from one to three layers of small, thick-sided cells, strongly cohering together so as to form a membrane, which may, in most cases, be stripped off from the pulp of the leaf. The cells of the upper surface are filled with more or less filled with matter deposited from liquids passing through them. The surface of the epidermis is generally covered with a thin coating of wax, or a white powder, which immediately serves to prevent the loss of further moisture for the time being. These stomata are found mostly on the under surface of leaves, for the reason that the strength of the direct sunlight will impair their effectiveness. Leaves which present their edges instead of surfaces to the sky and earth have the

## THE LEAVES OF PLANTS

stomata equally numerous on both sides; while the leaves which live under water, where there can be no evaporation, are destitute of stomata. And oftentimes of epidermis also. The number of these stomata varies from 800 to 170,000 to the square inch of surface. From their immense number we can realize what an effective check to undue evaporation is afforded by the covering of the leaf. The extent of exhalation of vapor from the foliage of trees depends entirely upon the state of the atmosphere. The absolute amount of exhalation can be quite accurately determined by simply noting the weight of the pot and plant during any given time. The exhalation of water by plants is not regular, but depends on numerous conditions. It is influenced by the dryness and temperature of the air, by the composition of the soil, its temperature and the amount of water in it, and by the different textural and structural conditions of the leaf. Exhalation is not detrimental to the plant, unless the loss exceeds the supply, and it is essential to the plant. The exhalation of moisture takes place through the epidermis and stomata of the leaves. It is through the agency of the leaves that the atmospheric air and other gases have access to the interior of the plant, and it seems to be the principal function of the foliage to absorb atmospheric air with the gases it contains, assimilate the carbon and other elements wanted by the plant, and then to expel the excess of oxygen, and quickly enter with some inorganic substance to form fresh material for plant food. It has been mentioned that all plants consist of a fixed and a volatile part.

The fixed part being the ash, and the last matter which disappears in the form of gases on the plant. The foliage serves to put the plant in communication with the medium into which this volatile part of the previously existing plants has been diffused, while the roots, which have no visible pores, and which are not penetrated by air and vapors to such an extent as are leaves, serve to put the plant into direct communication with the soil, where the fixed part or ash of the decayed plants has remained, and to a very considerable extent in fact, immediately avail one to the roots of growing plants. The function of these two classes of organs—foliage and roots—is literally to reconstruct the products of combustion into new vegetable matter. The roots gather the mineral ingredients from the soil and transmit them, dissolved in the sap, up into the interior of the stem and leaves, where they are met by matter which has been gathered from the atmosphere by the leaves, and the two classes of substances are, by means of the vegetable organisms, transformed into materials for plant food. When it is remembered that the volatile part of a plant is made up of 70 to 80 per cent of its whole weight, it will readily be seen that the foliage is called upon to supply much the largest part of the materials for plant growth. This fact accounts for the relatively great amount of surface exposed by the foliage of a plant.

THE FLOWER. Little need be said of the different organs of the flower and of their particular functions, for almost every observing agriculturist has at least a practical knowledge of the compositions and functions of the flower. With the putting forth of the terminal flower buds the plant intimates its intention of discontinuing its season's growth, and in many cases its individual life. The complete flower consists of four distinct parts of organs. Namely: the calyx, made up of the sepals; corolla, composed of petals; stamens and pistils. The calyx is the outermost floral envelope; its color is almost always green, but it is sometimes brightly colored. It is the protecting envelope of the flower buds, and though in some cases adhering, after the flower has opened its presence is not necessary to the development of the seed. The calyx is considered by botanists to be a sepal, each of which is termed a sepal. Just inside of the calyx, in the perfect flower, is found the corolla, consisting of from one to several series of generally highly colored petals. Generally the petals are composed of one or more individual leaves or parts termed petals. The petals are of almost every conceivable form and color, and it is to them that most flowers in horticulture owe their beauty. As with the calyx, the presence of the corolla is not necessary to fructification. The stamens are generally slender, thread-like organs, terminating in an oblong sac. They are called in number and are highly colored. The oblong sac is called the anther, and in mature flowers is filled with a yellow powder, which is the pollen. The center of the perfect flower is occupied by the pistil, having at its base the ovary, or seed vessel, of the flower, which contain the rudimentary seeds whereby the life of the species is perpetuated. The forms of the pistils in different flowers are exceedingly various, and are in many cases attracted to the extremity where the epidermis is lacking. This naked spot is the stigma, upon which the pollen from the anthers is lodged, either by the mechanical action of the winds, by the action of insects, or by artificial means. The contents of these grains of pollen find their way through the stigma and generally elongated pistil down to the ovules, and by this means the seed vessels are fertilized.

## THE STAMENS AND PISTILS

Are the only really essential organs of the flower, and the flower is often made up of them alone. Some flowers even contain only one of these two essential organs. In such cases either the plant also contains flowers of the opposite sex, and then the flower is termed a monoecious flower, or the opposite sex are borne by adjacent plants. Where the staminate and pistillate flowers do not both grow on the same stem, the plant is said to be dioecious. In dioecious plants the staminate flowers are brought about by fertilization from flowers of different trees. I should have said that the terms staminate and pistillate were used to designate flowers which had in the one case stamens and no pistils, and in the other case pistils and no stamens. These flowers have been termed respectively male and female. As the union of sexes of different kinds of animals often produces hybrids, so also may the crossing of different kinds of flowers. It is, however, a well-established fact that hybridization can only take place between closely allied species in the vegetable as well as animal kingdom. And its component parts may be considered as modified leaves. This seems to be the case from the fact that different conditions of growth influence the form of the product of the fundamental organ—the bud. The influence of the gardener's care on the essential organs—stamens and pistils—are often partly or wholly replaced by purely structural organs—petals—and the flower becomes double. All stages of this transformation are to be seen in the perfect petal to one of the unaltered pistil. In numerous cases it has been noticed that all of the floral organs of the flower reverted back to the primitive form, the green leaf. This fact is well attested, and cannot be doubted but that leaves and flowers are but modifications of one and the same fundamental organ, namely, the bud.

## THE SEED.

It is impossible in the limited space at hand to speak of the different forms of seeds, with their manner of growth, etc., etc. We will only say a few words of the parts of which they are composed, and of their fundamental importance, and which compose the vital organs of the seed and are directly concerned with the perpetuation of the species. Saying nothing of the different coats of the seed, we will merely say that the seed is really the seed proper. It often consists simply of the rudimentary plant or embryo, but in the

larger number of cases contains besides the supply of food, comprised in what has been termed the endosperm, and the contents of which are drawn upon by the young plant, and afford sustenance until the land plants will be able to perform their nutritive functions. The endosperm, with its supply of food, is not an infallible constituent of seeds, but is often entirely lacking. The embryo, which is in fact a miniature plant, with rudimentary organs, is the most important part of the seed. In dry seeds it is generally hard to distinguish the embryo, but if the seeds be soaked it can be easily removed from the endosperm and the seed coat. If we examine the embryo of a seed (one containing a large embryo, as the pumpkin or squash seed, is best), three parts will readily be distinguished. The lower part, or what seems to be the beginning of the stem, and from which the roots descend, is called the radicle. The ascending axis of the stem, and which is surrounded by a more or less perfectly developed bud, forms

## THE PLUMULE.

This is the part of the seed from which grows the stem of the plant with its appendages. The plumule is clasped and more or less enclosed by one or two rudimentary leaves. These are the cotyledons of the endosperm, and are in structure perfect leaves, whose tissues are generally filled with food for the young plant. These cotyledons often remain under ground, and thus can perform none of the functions of leaves. In others they are lifted out of the ground by the ascending plumule. In such cases, although they may sometimes imperfectly perform the functions of leaves, they generally, after their contents have been appropriated by the young plant, become effete. Therefore, to reason why seeds, if protected from oxygen, moisture and insects, should retain their vitality for an indefinite period. But owing to the impossibility of practically fulfilling these conditions, all seeds may be said to have a comparatively short period of vitality. In general, the seeds of most plants will grow if they are not dried too much, and the larger they are the longer they will retain their vitality. Also, as a general thing, the newer a seed and the more mature it is, the more vigorous will be the growth of the plant. With this increased vigor of growth there is a longer period of growth and often a decreased yield of seed. This fact is taken advantage of by the gardener and florist, who will sow early maturing crops of vegetables and new varieties of flowers by planting old, and hence weak seeds. Plants develop from these, which, instead of having a vigorous growth, spend a comparatively larger part of their life in the seed, and thus the degree of maturity of a seed also sensibly affects its offspring. If plants—wheat for instance—be cut before the seeds are ripe, and even just before the starch is formed, the seeds will not mature properly, and the plants which are not dried too suddenly, and will be

## CAPABLE OF GERMINATING.

As would be supposed, the proportion of seeds ripened under such circumstances, which would grow, would be less than if they had ripened on the roots. Such seeds also produce weaker plants, and in poor soils often light crops. In rich soils, on the contrary, they will generally give as large a yield as any other seed, and will in addition ripen their seed in from one to several weeks earlier than plants from fully matured seed. In fact, the maturity of the seed being forced by separating it from the parent root, it will in turn, half intuitively, force its offspring to an early maturity, seemingly so that it will be matured before the parent plant is fully matured. The fact that it is so, the maturity of the seed being forced by separating it from the parent root, it will in turn, half intuitively, force its offspring to an early maturity, seemingly so that it will be matured before the parent plant is fully matured. 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